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November 30, 2016

Mr. David A. Byerman, Director  
Legislative Research Commission  
Room 300, Capitol  
Frankfort, KY 40601

Dear Mr. Byerman,

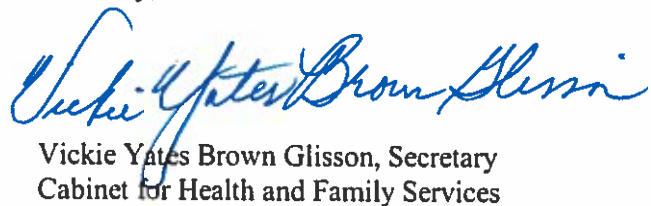
Kentucky is blessed with rich natural resources and it is essential that we ensure a strong economy and healthy environment in the use of those resources. Our nation has experienced an expansion of energy production and Kentucky has the potential to see development of new sources of energy in the future. One aspect of energy production is the need to ensure that the production of oil and gas is consistent with applicable laws and regulations that are clear and protective.

The Kentucky General Assembly passed HB563 in the 2016 Regular Session in response to concerns with management of radioactive materials from oil and gas production. KRS 211.893 directed the Energy and Environment Cabinet and the Cabinet for Health and Family Services to revise existing regulations in order to ensure the proper management of oil- and gas-related waste.

The agencies have collaborated with the groups identified in KRS 211.863(3) and have prepared the enclosed report of progress. If you have any questions or would like additional information, please contact Rick Bender, chair of the Kentucky Oil and Gas Work Group at 502-782-6888 or [rick.bender@ky.gov](mailto:rick.bender@ky.gov).

Sincerely,

  
Charles Snavely, Secretary  
Energy and Environment Cabinet

  
Vickie Yates Brown Glisson, Secretary  
Cabinet for Health and Family Services

enclosure

# **Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM) Associated with Oil and Gas Activities**

Report to the Kentucky Legislative Research Commission Pursuant to  
2016RS HB 563

Prepared by the Kentucky Energy and Environment Cabinet  
and Kentucky Cabinet for Health and Family Services

**November 30, 2016**





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## **SECTION 1. BACKGROUND**

The United States Congress passed the 1980 Low-Level Radioactive Waste Policy Act which established that it is the responsibility of the states to manage and dispose of Low Level Radioactive Waste (LLRW) generated within its borders and encouraged the creation of regional compacts. Kentucky is a member of the Central Midwest Interstate Low-Level Radioactive Waste Compact with the State of Illinois. The Regional Management Plan (RMP) developed by the compact prohibits the import and disposal of LLRW into the compact states from non-party states. The RMP establishes that naturally occurring radioactive materials (NORM) are not excluded from the definition of LLRW and are therefore subject to the import and disposal prohibition. The RMP also defines technologically enhanced radioactive materials (TENORM) where the concentration of radioactive materials is increased due to human activities.

In the summer of 2015, waste containing TENORM from oil and gas operations originating from a non-compact state was disposed at a landfill located in Estill County, Kentucky by companies that processed and enhanced the waste. The prohibited waste continued to be imported and disposed of in the landfill through November 2015. The Kentucky Division of Waste Management learned in January 2016 that the out-of-state prohibited waste had been disposed of at a landfill in Greenup County and subsequently learned of the disposal in Estill County. The Division issued a notice in February 2016 to owners and operators of all contained landfills in Kentucky that it was their duty to comply with all statutes and regulations regarding radioactive materials.

The Energy and Environment Cabinet includes the Department for Environmental Protection which among its duties regulates solid waste facilities by the Division of Waste Management and potential impact of oil and gas facilities on surface and groundwater by the Division of Water. The Department for Natural Resources within the cabinet includes the Division of Oil and Gas which regulates oil and gas operations in Kentucky.

The Cabinet for Health and Family Services is the radiation control agency for the Commonwealth and has statutory authority to regulate all radioactive materials including NORM and TENORM. The Department for Public Health licenses and registers sources of radiation and provides monitoring and testing capabilities for radioactive materials.

Expanded oil and gas production in the Marcellus and Utica shale formations in the northeastern United States has resulted in lower natural gas prices from this increased domestic production. Use of technologies including horizontal drilling and hydraulic fracturing have improved gas production but often result in an increase in associated drilling materials

and waste with elevated radioactivity due to the nature of the specific geological formations and the associated solubility of radium-226<sup>1</sup> in water from those formations.

Due to concerns associated with NORM and TENORM wastes from oil and gas development, the challenge of managing those concentrated or enhanced wastes, and the subsequent illegal import of wastes with enhanced concentrations of radioactive materials into Kentucky, the Kentucky General Assembly passed House Bill 563 during the 2016 regular session. The bill directed the Energy and Environment Cabinet and Cabinet for Health and Family Services to review and revise existing regulations to ensure proper management of oil and gas-related wastes including consideration of development of a manifest system, review of waste and water permitting programs, and recommended changes to existing statutes. The General Assembly recommended that the agencies seek input from oil and gas operators, transporters of waste, the public, landfill operators, and the Conference of Radiation Control Program Directors in revising regulations. The bill codified as KRS 211.893 requires the cabinets to report to the Legislative Research Committee on their progress in complying with KRS 211.893 by December 1, 2016

The Energy and Environment Cabinet had convened an Oil and Gas Workgroup to address several issues raised by SB 186 in the 2015 Legislative Session to undertake a comprehensive modernization and strengthening of the oil and gas program. By memorandum dated March 11, 2016 the Energy and Environment Cabinet reconvened the Oil and Gas Workgroup to address KRS 211.893 and expanded the workgroup to include the groups identified in HB 563. This enhanced workgroup ensured that the goals and directives of HB 563 would have the greatest opportunity to be realized due to the foundation that had already been established during 2015. A copy of the memorandum to workgroup members follows.

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<sup>1</sup> Radium-228, a more short-lived radionuclide, is also soluble. The workgroup consensus was that radium-226 would be the driver for regulatory determinations regarding oil and gas TENORM waste management.



MATTHEW G. BEVIN  
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CHARLES G. SNAVELY  
SECRETARY


**ENERGY AND ENVIRONMENT CABINET  
DEPARTMENT FOR NATURAL RESOURCES**

ALLEN LUTTRELL  
Commissioner

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<http://dnr.ky.gov>

**MEMORANDUM**

**TO:** Rusty Cress, Kentucky Chapter of National Waste & Recycling Association  
Dave Adkisson, Kentucky Chamber of Commerce  
William Barr, Blackridge Resource Partners LLC  
Steve Coleman, Environmental Quality Commission  
Kim Collings, Division of Oil & Gas  
William Daugherty, Blackridge Resource Partners, LLC  
William Donan, Mine Safety Review Commission  
Tom FitzGerald, Kentucky Resources Council  
Larry Taylor, DEP  
John Horne, Office of General Counsel  
Monte Hay, Hay Exploration  
Allen Luttrell, Department for Natural Resources  
Doug Hyden, Clean Gas LLC  
Curt Pendergrass, Department for Public Health/Radiation Health Branch  
Maurice Royster, EQT Corporation  
Reggie Van Stockum, Attorney- at-Law  
Chester Thomas, Green River Collieries, LLC  
Rudy Vogt, Executive Director of COGA  
Brandon Nuttall, Kentucky Geologic Survey

**FROM:** Charles G. Snavely, Secretary  
Energy and Environment Cabinet 

**DATE:** March 11, 2016

**RE:** Oil and Gas Workgroup

The creation of the Oil and Gas Workgroup resulted in the successful modernization of the statutes and administrative regulations governing oil and gas exploration in the Commonwealth with the passage of SB 186 in the 2015 Legislative Session. The workgroup also agreed upon the draft of SB 188 currently proceeding through the 2016 Legislative Session. However, I believe there are more issues that need to be addressed by the workgroup and I am requesting the workgroup reconvene in order to address these issues.



Oil and Gas Workgroup Memo  
March 11, 2016  
Page No. 2

One issue recently gaining attention is oil and gas drilling muds containing low-level radioactive wastes. This is an issue that is prime for discussion and action by the workgroup. Therefore, I am requesting you to serve on the Oil and Gas Workgroup to:

- Review current issues that are impacting the oil and gas industry;
- Review the current administrative regulations and statutes;
- Suggest revisions to statutes and administrative regulations that are appropriate;

I have asked the Department for Natural Resources Commissioner, Allen Luttrell to chair this Workgroup. I will attend the first meeting in order to meet those of you I haven't had the chance to meet as well as direct the focus of the Workgroup. Personnel within the Department for Natural Resources and Department for Environmental Protection will be staffing the Workgroup.

I hope you are willing to serve on this Workgroup and for past members I hope your willingness continues. Please contact Haley McCoy in my office with your decision to participate in the Work Group by March 20, 2016. She can be reached by calling (502) 564-3350 or by email at Haley.McCoy@ky.gov. Our hope is to have the first meeting in mid April and we will try our best to accommodate everyone's schedule.

Thank you for your consideration of this request and if you have any questions please don't hesitate to call me.

CGS:mw

## SECTION 2. ENACTED HB563 – KRS 211.893

### **211.893 Legislative findings relating to naturally occurring radioactive material (NORM) -- Required revision of administrative regulations to ensure proper management of oil- and gas-related wastes containing NORM -- Report to LRC.**

- (1) The General Assembly finds that:
  - (a) "Naturally occurring radioactive material" or "NORM" is a term defined in KRS 211.862;
  - (b) Certain oil and gas production and storage activities result in the concentration or enhancement of the natural radioactivity of rocks or soils into NORM;
  - (c) The Cabinet for Health and Family Services, Radiation Health Branch, is charged by KRS 211.842 with responsibility for radiation control in the Commonwealth;
  - (d) The Division of Oil and Gas, the Division of Water, and the Division of Waste Management in the Energy and Environment Cabinet issue permits addressing oil and gas exploration and production operations and management of associated wastes;
  - (e) The Energy and Environment Cabinet, Division of Oil and Gas was directed in 2003 to promulgate administrative regulations and take all actions necessary to ensure efficient oil and gas operations and to protect the property, health, and safety of the citizens of the Commonwealth in a manner consistent with KRS Chapter 353;
  - (f) The Cabinet for Health and Family Services is specifically authorized to adopt administrative regulations necessary to implement the Central Midwest Interstate Low-Level Radioactive Waste Compact; and
  - (g) The need for review and revision of the statutes and regulations associated with management of NORM wastes is necessary and advisable in order to ensure proper management and disposal of wastes containing NORM generated within or outside the Commonwealth.
- (2) The Energy and Environment Cabinet and the Cabinet for Health and Family Services are directed to exercise their regulatory authority to revise existing regulations in order to ensure the proper management of oil- and gas-related wastes containing NORM, including consideration of such issues as:
  - (a) Development of a manifest system for the transport and disposal of NORM wastes and wastewater;
  - (b) Development of administrative regulations as authorized by the General Assembly in KRS 211.865(3);
  - (c) Review of state waste and water permitting programs to ensure proper management of wastes and wastewaters containing NORM; and
  - (d) Identification of and recommendations on any changes to existing statutes in order to facilitate management of oil and gas production wastes in a manner commensurate with the risks that those wastes may pose to the public health and the environment.
- (3) The Energy and Environment Cabinet and the Cabinet for Health and Family Services are encouraged to seek input from oil and gas producers, transporters

of oil and gas wastes, the public at large, environmental organizations, the Kentucky Geological Survey, landfill owners and operators, and the Conference of Radiation Control Program Directors, among others, in revising the administrative regulations. The Energy and Environment Cabinet and the Cabinet for Health and Family Services shall report to the Legislative Research Commission their progress in complying with this section by December 1, 2016.

**Effective:** April 13, 2016

**History:** Created 2016 Ky. Acts ch. 130, sec. 1, effective April 13, 2016.

### **SECTION 3. WORKGROUP MEMBERSHIP**

#### **Oil and Gas Workgroup**

Rick Bender	Department of Energy Development and Independence – Chair
Rusty Cress	Kentucky Chapter of National Waste and Recycling Association
Scott Smith	SMG\Kentucky Chamber of Commerce
William Barr	Blackridge Resource Partners, LLC
Steve Coleman	Environmental Quality Commission
Kim Collings	Kentucky Division of Oil and Gas
William Daugherty	Blackridge Resource Partners, LLC
William Donan	Mine Safety Review Commission
Tom FitzGerald	Kentucky Resources Council
Larry Taylor	Department for Environmental Protection
John Horne	Office of General Counsel
Monte Hay	Hay Exploration
Allen Luttrell	Department for Natural Resources
Doug Hyden	Clean Gas, LLC
Curt Pendergrass	Department for Public Health
Maurice Royster	EQT Corporation
Reggie Van Stockum	Attorney-at-Law
Chester Thomas	Green River Collieries, LLC
Rudy Vogt	Cumberland Valley Resources, LLC
Brandon Nuttall	Kentucky Geological Survey
Matt Sawyers	Kentucky Oil and Gas Association

#### **Workgroup Attendees**

Charles Snavelly	Energy and Environment Cabinet
Bruce Scott	Energy and Environment Cabinet
Jackie Quarles	Energy and Environment Cabinet
Jeffrey Harmon	Energy and Environment Cabinet
Lance Huffman	Energy and Environment Cabinet
Haley McCoy	Energy and Environment Cabinet
John Mura	Energy and Environment Cabinet
Tony Hatton	Department for Environmental Protection
Pete Goodman	Division of Water
Michael Mullins	Department for Natural Resources
Marvin Combs	Kentucky Division of Oil and Gas
Steven Davis	Cabinet for Health and Family Services

Justin Clark	Cabinet for Health and Family Services
Eric Clark	Cabinet for Health and Family Services
Jennifer Wolsing	Cabinet for Health and Family Services
Connie White	Cabinet for Health and Family Services
Laura Begin	Department for Public Health
Matt McKinley	Department for Public Health
Justin Carey	Department for Public Health
Andrew McNeill	Office of the Governor
Liz Natter	Office of Attorney General
Barbara Whaley	Office of Attorney General
Glenna Goins	Governor's Office of Policy and Management
Rep. Dennis Keene	Kentucky State Legislature
Laura Cole	Kentucky Oil and Gas Association
Jason Bentley	MMLK\KOGA
Andrew Pulliam	Kentucky Petroleum Marketers Association
Robert Lee	KY Chapter, National Waste and Recycling Association
Mike Hext	Waste Management, Inc.
Kathy Trent	Waste Management, Inc.
John Cooper	Waste Management, Inc.
Rich Thompson	Republic Services
Bill Chlebowy	Republic Services
James Jitter Allen	Republic Services
Linda Magee	Republic Services
Gregory Butler	Republic Services
Dan Fleshour	Advanced Disposal
David Rettell	Advanced Disposal
Lane Boldman	Kentucky Conservation Committee
Bruce Schmucker	Cornerstone Environmental Group
Bob Babbage	Babbage Cofounder
Julie Babbage	Babbage Cofounder
Mark Pierce	Nytis Exploration
Andy Lombardo	Perma-Fix
Stephanie Stumbo	Goss Samford
Allyson Honaker	Goss Samford
Taylor Bumgardner	Goss Samford
Karen Greenwell	Wyatt, Tarrant, and Combs, LLC
John Danna	Chemtech Consulting
Steve Hampson	UK-Center for Applied Energy Research

Steve Hohmann	Cumberland Surety
Jeff Busick	MSS\Cimarex
Sherman Brown	McCarthy Strategic Solutions
Kate Shanks	Kentucky Chamber of Commerce
Deanna Picklesimer	Cornerstone Environmental
James Bruggers	Courier-Journal
Jamie Lucke	Lexington Herald-Leader

#### **SECTION 4. MEETING DATES**

As a workgroup appointed by a public agency and convened in response to KRS 211.863 to review and make recommendations regarding the Kentucky oil and gas program and public policy, the Workgroup held open meetings in compliance with Kentucky Open Meetings laws in KRS Chapter 61. Meetings were scheduled, announced to the public and held on:

May 12, 2016 at 1 p.m.

June 2, 2016 at 1 p.m.

July 7, 2016 at 9 a.m.

August 4, 2016 at 9 a.m.

September 8, 2016 at 9 a.m.

October 11, 2016 at 9 a.m.

November 1, 2016 at 9 a.m.

December 9, 2016 at 9 a.m. (scheduled and announced)

## SECTION 5. MEETING MINUTES

### Oil and Gas Workgroup Minutes Meeting #1

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Minutes of the first meeting held on May 12, 2016: A meeting of the Oil and Gas Workgroup was held in the Department for Natural Resources conference room D-16 in Frankfort KY.

- **Members Present:** Sec. Charles Snavely, Rick Bender, Bill Daugherty, Bill Barr, Brandon Nuttall, Curt Pendergrass, Doug Hyden, Bill Donan, Steve Coleman, Monte Hay, Rudy Vogt, Kim Collings, Marvin Combs, Larry Taylor, Reggie Van Stockum, Maurice Royster, Justin Clark, Connie White, Scott Smith, Rusty Cress, Tony Hatton, John Horne, and Tom FitzGerald.
- **Support Staff and Citizens Present:** Andy Lombardo, Allyson Honaker, Andrew Pulliam, John Danna, Astrud Masterson, Karen Greenwell, Lane Boldman, Jennifer Wolsing, Dan Fleshour, Lance Huffman, Mike Hext, Steve Hampson, Haley McCoy, John Mura, Jeff Busick, Jason Bentley, Bruce Scott, Laura Begin, Kate Shanks, James Bruggers, and Michael Mullins
- **Meeting Time:** The meeting was called to order at 1:00 pm EST.
- **Opening Remarks:** Secretary Snavely made opening remarks and discussed the focus of the workgroup moving forward.
- **Discussions:** Discussion at the meeting centered around six presentations presented by various members and guests. The workgroup is to discuss and address TENORM issues
  - **Review of HB 563 – Rick Bender:** A brief overview of the contents of HB 563 was given to the workgroup members.
    - Background information on the situation in Estill County that resulted in the filing of HB 563.
    - Enforcement actions currently ongoing against entities responsible as well as an investigation from the Attorney General’s Office.
    - HB 563 directs the workgroup to review TENORM policies of the Commonwealth and consider developing a manifest system as well as revised permitting provisions and management of oil and gas wastes.
    - EEC and CHFS shall report to the Legislative Research Commission their progress in complying with this section by December 1, 2016.
  - **TENORM Study Conducted by Pennsylvania Department of Environmental Protection (PDEP) – Andrew Lombardo:** Mr. Lombardo’s presentation provided



detailed information on the Pennsylvania study and the PDEP process the department went through to create a TENORM program within the state.

- NORM and TENORM issues are typically handled at the state level.
- A revision to the study is expected to be published soon. Edits are due in one to two weeks.
- **TENORM Scanning at Oil & Gas Production Facilities – Marvin Combs:** Assistant Director Combs' presentation focused mainly on how the Division of Oil and Gas addresses NORM and TENORM issues in the Commonwealth.
  - Division scanning procedures:
    1. Establishing background;
    2. Scan production facilities, tubing/casing
    3. Identify any facilities above background
    4. Capture GPS of facilities (above background)
    5. Document-Contact Frankfort Office
    6. Contact CHFS Radiation Branch
  - DOG performs an initial scan and follow up scan to ensure accurate readings.
- **Review of Current Health Regulations under KRS 211.859-211.863 – Curt Pendergrass:** Mr. Pendergrass' presentation provided the workgroup with information concerning the federal and state policies regarding low level radioactive wastes as well as information on the current compacts and disposal sites across the nation.
- **Special Waste/NORM/TENORM – Tony Hatton:** Director Hatton gave information regarding how TENORM wastes fit into the current DWM regulatory scheme.
- **Kentucky Division of Water Regulation for Control of Water Pollution from Oil and Gas Facilities, 401 KAR 5:090 – Larry Taylor:** Mr. Taylor gave the workgroup background on the requirements of 405 KAR 5:090 and the necessity for amendment of the regulation to address possible TENORM issues and other oil and gas issues for later discussion.
- **Tasks assigned for the next meeting of the workgroup.**
  1. Definition of NORM and TENORM and development of an appropriate risk-based TENORM number – CHFS, DWM, and Reggie Van Stockum.
  2. KY landfills not accepting oil and gas wastes – Internal Cabinet Discussions.
- **Public Comment:** The workgroup did not receive public comment on this meeting.
- **Next Meeting:**

- The next meeting is scheduled for June 2, 2016 at 1:00 pm in the Department for Natural Resources conference room D-16, #2 Hudson Hollow.
- **Adjournment**

## Oil and Gas Workgroup Minutes Meeting #2

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Minutes of the second meeting held on June 2, 2016: A meeting of the Oil and Gas Workgroup was held in the Department for Natural Resources conference room D-16 in Frankfort KY.

- **Members Present:** Rick Bender, Bill Daugherty, Bill Barr, Curt Pendergrass, Doug Hyden, Steve Coleman, Rudy Vogt, Kim Collings, Marvin Combs, Larry Taylor, Reggie Van Stockum, Maurice Royster, Justin Clark, Scott Smith, Rusty Cress, Tony Hatton, John Horne, and Tom FitzGerald.
- **Support Staff and Citizens Present:** John Danna, Laura Cole, Glenna Goins, Justin Carey, Jennifer Wolsing, Pete Goodman, Dan Fleshour, Lance Huffman, Mike Hext, Gregory Butler, Haley McCoy, John Mura, Jeff Busick, Linda Magee, James Allen, Rep. Dennis Keene, Jason Bentley, Bruce Scott, Stephanie Stumbo, Kate Shanks, and Michael Mullins
- **Meeting Time:** The meeting was called to order at 1:00 pm EST.
- **Opening Remarks:** Rick Bender made opening remarks and started the meeting according to the provided agenda.
- **Discussions:** Discussion at the meeting was mainly focused on the definitions of NORM and TENORM and levels of risk associated with NORM and TENORM.
  - **Basic Radiological Information – Curt Pendergrass:** Mr. Pendergrass gave a quick overview of basic radiological information for those that were unfamiliar with the terminology and methods of measurement.
  - **Discussion on the definitions of NORM and TENORM:** Discussion was opened by clarifying that NORM is naturally occurring while TENORM is technologically enhanced.
  - The state definition of NORM actually defines TENORM which is different than the typical usage.
  - A question was raised whether NORM brought to the surface by drilling or any other excavating action would be considered TENORM. Opinions varied.
  - Bill Barr and Tom FitzGerald were asked to work together to come up with definitions of both NORM and TENORM.

- **Levels of Risk:** CHFS proposed 5 pCi/g above background as the *de minimis* level.
- Background is not the same all over KY and would require a study to determine an average number. Background should be sampled as an onsite test.
- The waste management industry has not met to discuss the issue. However, their representatives did not believe that they would be in favor of on-site testing.
- **Tasks assigned for the next meeting of the workgroup.**
  1. Definition of NORM and TENORM and development of a strawman – Bill Barr and Tom FitzGerald.
  2. Waste industry to discuss issues related to accepting TENORM wastes and provide a presentation – Rusty Cress.
  3. Sampling procedures – Curt Pendergrass
- **Public Comment:** The workgroup did not receive public comment at this meeting.
- **Next Meeting:**
  - The next meeting is scheduled for July 7, 2016 at 9:00 am in the Energy and Environment Cabinet’s new building
- **Adjournment**

## Oil and Gas Workgroup Minutes Meeting #3

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Minutes of the third meeting held on July 7, 2016: A meeting of the Oil and Gas Workgroup was held in the Energy and Environment Cabinet First Floor Training Room 116-C in Frankfort KY.

- **Members Present:** Rick Bender, Bill Daugherty, Bill Barr, Curt Pendergrass, Steve Coleman, Rudy Vogt, Kim Collings, Marvin Combs, Reggie Van Stockum, Monty Hay, Maurice Royster, Scott Smith, Rusty Cress, Tony Hatton, Matthew McKinley, Brandon Nuttall, Connie White, and Tom FitzGerald.
- **Support Staff and Citizens Present:** John Danna, Laura Cole, Glenna Goins, Jennifer Wolsing, Rich Thompson, Lance Huffman, Mike Hext, Gregory Butler, Haley McCoy, Barbara Whaley, Jeff Busick, Jim Bruggers, Lane Boldman, Jamie Lucke, Mark Pierce, Jackie Quarles, Bruce Schmucker, Robert Lee, Laura Begin, Liz Natter, Jason Bentley, Bruce Scott, Kate Shanks, and Michael Mullins
- **Meeting Time:** The meeting was called to order at 9:00 am EST.

- **Opening Remarks:** Rick Bender made opening remarks and notified the group he would be providing a status update of on the progress of the workgroup at the July 19<sup>th</sup> IJC on Natural Resources and Environment. The meeting started according to the provided agenda.
- **Discussions:** Discussion at the meeting followed the agenda and covered waste management issues, sampling and testing, as well as the strawman provided by Tom FitzGerald.
  - **National Waste and Recycling Association Presentation – Rusty Cress and Mike Hext:** The presentation focused on the Kentucky's requirements for pre-waste acceptance protocols as well as waste profiling. The presentation was provided to the group in a follow-up email.
  - **Discussion on the sampling and testing – Brandon Nuttall:**
  - The discussion centered on sampling techniques, standardized units, and determination of Kentucky's standardized background.
  - Standardized background would be possible but could be a lengthy process. If a standardized background level was determined then an allowance would need to be made for entities to do onsite sampling to determine site specific background.
  - Members of the workgroup expressed a need for exposure levels across the state to be determined before the group talks about waste and oil and gas impacts.
  - The workgroup was reminded that the focus of the workgroup is to discuss the TENORM issue not NORM. However, other members expressed concern that an increased risk of exposure by drilling and bringing NORM to the surface results in TENORM.
  - **Discussion of Tom FitzGerald's strawman:** Mr. FitzGerald indicated a consensus was not reached on the definitions or the strawman by the smaller group that discussed the strawman prior to the meeting. The workgroup went through the strawman by section and discussed the draft.
  - The discussion centered on the definitions and risk levels. Deputy Secretary Scott indicated the definitions would largely be driven by the levels the workgroup establishes.
  - The workgroup's discussion resulted in tentative levels as follows:
    1. Below 5 pCi/g = Leave in place.
    2. 5 pCi/g – 15 pCi/g = Manage on-site.
    3. Less than 50 pCi/g = Can be sent to a landfill.
    4. Above 50 pCi/g = Low level radiation landfill.

- The workgroup was asked to consider a Permit-by-Rule (PBR) for drill cuttings. Possibly 15 pCi/g or below could be established for a PBR.
- **Tasks assigned for the next meeting of the workgroup.**
  - 1. Brandon Nuttall was asked to send some sampling data to Rick Bender prior to the IJC presentation.
- **Public Comment:** The workgroup did not receive public comment at this meeting.
- **Next Meeting:**
  - The next meeting is scheduled for August 4, 2016 at 9:00 pm in the Energy and Environment Cabinet's Training Room 116-C.
- **Adjournment**

## Oil and Gas Workgroup Minutes Meeting #4

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Minutes of the fourth meeting held on August 4, 2016: A meeting of the Oil and Gas Workgroup was held in the Energy and Environment Cabinet First Floor Training Room 116-C in Frankfort KY.

- **Members Present:** Rick Bender, Bill Daugherty, Bill Barr, Rudy Vogt, Kim Collings, Reggie Van Stockum, Monty Hay, Maurice Royster, Scott Smith, Larry Taylor, Rusty Cress, Brandon Nuttall, Doug Hyden, and Tom FitzGerald.
- **Support Staff and Citizens Present:** Sec. Charles Snavelly, Deputy Sec. Bruce Scott, Haley McCoy, Gregory Butler, Lane Boldman, Jeff Busick, Mark Pierce, Laura Cole, Jennifer Wolsing, Laura Begin, Jason Bentley, Matt Sawyers, Kate Shanks, Stephanie Stumbo, and Michael Mullins
- **Meeting Time:** The meeting was called to order at 9:00 am EST.
- **Opening Remarks:** Rick Bender made opening remarks. The meeting started according to the provided agenda.
- **Discussions:** Discussion at the meeting followed the agenda and covered waste management issues, sampling and testing, as well as the strawman provided by Tom FitzGerald.
  - **Discussion on Tom FitzGerald's strawman:** Discussed acceptable limits for waste streams from oil and gas drilling sites.

- Dosimetry should be required for landfills but not generators because the waste hasn't been characterized.
- Downblending – Discussion centered on the impacts of downblending and whether the workgroup should agree to add it to the proposed draft.
  1. Will solidification be allowed to be a tool for management of wastes as well?
  2. Solidification and downblending should be accomplished by an offsite facility.
  3. CHFS indicated the offsite facility would need to be licensed.
- Limit characterization of wastes to Ra 226 and Th 232.
- Onsite coverage for oil and gas cuttings is proposed in the draft to be three feet. This would cause a problem for some locations in eastern Kentucky.
- Representatives of the oil and gas industry proposed a coverage of 1 ½ feet of coverage which would include the use of a liner.
- **Tasks assigned for the next meeting of the workgroup.**
  1. Tom FitzGerald would revise the strawman to include the items discussed in the meeting.
  2. Representatives of the oil and gas industry would discuss coverage options with more members to ensure the 1 ½ feet of coverage would work for their members.
- **Public Comment:** The workgroup did not receive public comment at this meeting.
- **Next Meeting:**
  - The next meeting is scheduled for September 8, 2016 at 9:00 pm in the Energy and Environment Cabinet's Training Room 116-C.
- **Adjournment**

## Oil and Gas Workgroup Minutes Meeting #5

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Minutes of the fifth meeting held on September 8, 2016: A meeting of the Oil and Gas Workgroup was held in the Energy and Environment Cabinet First Floor Training Room 116-C in Frankfort KY.

- **Members Present:** Rick Bender, Bill Daugherty, Bill Barr, Maurice Royster, Monty Hay, Steve Coleman, Rudy Vogt, Doug Hyden, John Horne, Kim Collings, Marvin Combs,

Reggie Van Stockum, Scott Smith, Rusty Cress, Larry Taylor, Justin Clark, Matthew McKinley, Brandon Nuttall, Connie White, and Tom FitzGerald.

- **Support Staff and Citizens Present:** Deputy Secretary Bruce Scott, Laura Cole, Glenna Goins, Jennifer Wolsing, David Rettell, Mike Hext, Kathy Trent, Haley McCoy, Gregory Butler, Robert Lee, Mark Pierce, Bruce Schmucker, Laura Begin, Sherman Brown, Taylor Bumgardner, Bob Babbage, Julie Babbage, Jason Bentley, Peter Goodman, Kate Shanks, and Michael Mullins
- **Meeting Time:** The meeting was called to order at 9:00 am EST.
- **Opening Remarks:** Rick Bender made opening remarks and mentioned the Cabinet for Health and Family Services drafted an administrative regulation version of their own. The meeting started according to the provided agenda.
- **Discussions:** Discussion at the meeting started by determining which version of the regulation the workgroup was going to follow, the version established and worked on by the workgroup in previous meetings or the version drafted by CHFS. The meeting followed the agenda and covered waste management issues, sampling and testing, as well as the strawman provided by Tom FitzGerald.
  - **Discussion of Tom FitzGerald's strawman:** The workgroup decided to follow the version of the draft created by Tom FitzGerald since it had workgroup consensus.
    1. Tom FitzGerald agreed that thorium-232 is not an issue for oil and gas sites and should be removed from the draft. However, operators may need to test for actinium.
    2. Deputy Secretary Scott believes that a separate regulation for oil and gas sites would be beneficial rather than trying to tackle the entire TENORM issue at once. Most of the workgroup agreed. HB 563 directs the workgroup to address TENORM from oil and gas operations. CHFS would rather have one administrative regulation dealing with contamination from all TENORM sources not just oil and gas.
    3. CHFS agreed to check on the cost and time for a thorium-232 test.
    4. Pit liners were discussed and will be included for pits. A 12 mill liner was agreed to be an appropriate thickness.
    5. The workgroup discussed if landfills that accept TENORM wastes will need to comply with RCRA Part C requirements for landfills.
    6. Downblending was discussed. CHFS and Tom FitzGerald are not in favor of downblending.
    7. Representatives of the oil and gas industry are in favor of downblending for scales and sludge in order to get the wastes below the 50 pCi landfill

limit. CHFS doesn't allow downblending for other industries and doesn't think it is appropriate for oil and gas operations.

8. Representatives of the oil and gas industry asked the workgroup to consider downhole disposal of TENORM contaminated pipe, scale, and sludge material at next meeting. If the workgroup can come to an agreement on downhole disposal then downblending is not as much of an issue for inclusion in workgroup recommendations.

- **Tasks assigned for the next meeting of the workgroup.**
  - Tom FitzGerald will modify the draft to correspond with the work group's agreed upon recommendations from this meeting.
- **Public Comment:** The workgroup did not receive public comment at this meeting.
- **Next Meeting:**
  - The next meeting is scheduled for October 11, 2016 at 9:00 am in the Energy and Environment Cabinet's Training Room 116-C.
  - The November meeting has been rescheduled for November 1<sup>st</sup>.
- **Adjournment**

## **Oil and Gas Workgroup Minutes Meeting #6**

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Minutes of the sixth meeting held on October 11, 2016: A meeting of the Oil and Gas Workgroup was held in the Energy and Environment Cabinet First Floor Training Room 116-C in Frankfort KY.

- **Members Present:** Bill Daugherty, Bill Barr, Maurice Royster, Monty Hay, Steve Coleman, Rudy Vogt, Doug Hyden, John Horne, Kim Collings, Reggie Van Stockum, Scott Smith, Rusty Cress, Larry Taylor, Justin Clark, Connie White, Bill Donan, Matt Sawyers, and Tom FitzGerald.
- **Support Staff and Citizens Present:** Secretary Charles Snavely, John Mura, Jeff Busick, Jeffrey Harmon, Curt Pendergrass, Laura Cole, Deanna Picklesimer, Jennifer Wolsing, Mike Hext, Haley McCoy, Gregory Butler, Robert Lee, Mark Pierce, Steve Hohmann, Bruce Schmucker, Laura Begin, Taylor Bumgardner, Jason Bentley, and Kate Shanks
- **Meeting Time:** The meeting was called to order at 9:10 am EST.
- **Opening Remarks:** Larry Taylor served as chair and made opening remarks and reviewed the agenda. The meeting started according to the provided agenda.



- **Discussions:** Initial concerns were raised regarding the broadening of the scope of the CHFS draft regulation and the amount of work that has been put into discussing and writing the processes and work group products. There was concern that the draft regulation deviates from the working definitions and assumptions that the work group has developed. It was suggested that the work group give CHFS the opportunity to present their case and provide them feedback on the draft regulation at that point in the agenda.
  - **Discussion of the revised working document:** The workgroup reviewed the version of the draft dated 9/9/2016 created by Tom FitzGerald.
    1. There was continued discussion on the definition of NORM and TENORM in the Working Document.
    2. The chair indicated that the 9/9/2016 Working Document should be updated to reflect that CHFS has also conducted outreach by sending letters to all state radiation control agencies except for Hawaii.
    3. CHFS asked if the work group was only going to concern itself with just radium-226. Tom FitzGerald responded that in doing the RESRAD modeling that radium-226 was the one that had the longevity and presence that needed to be considered in regard to oil and gas-related waste. Radium-228 did not have the persistence and thorium-232 would not be expected to be present due to low solubility in produced water. It was pointed out that the working document states that the working definitions and assumptions apply to the characterization and management for oil and gas production. Other wastes may have different radionuclides present.
    4. CHFS indicated that a typical laboratory test already would include a number of radionuclides in a panel and cost about 100 dollars. Testing and analyses were discussed further along with transport and shipping of samples to a lab especially if it is an unknown concentration. FedEx can ship higher levels of radioactivity with proper controls.
    5. A question was asked whether the 25,000 pound limit from the North Dakota and Argonne study should be included in the 5 pCi/g to 50 pCi/g category in 3.b)i. The work group members responded that that criterion was not included and Tom FitzGerald said that the issue is more with total activity than total pounds or tons of waste.
    6. A question was raised whether CHFS will license landfills over 50 pCi/g. CHFS indicated that it would be jointly regulated with the Division of Waste Management with each agency regulating within their authority.

7. Downblending performed by an authorized processor and the statistical rationale for the limit was discussed. The work group was asked if anyone had concerns with the proposed limit of 70 pCi/g. A clarifying question was asked regarding how that number would be used. Under the draft CHFS regulations, the waste would be characterized with 5 homogeneous samples and the average would be used to determine disposal options. In this case if the average was over 50 pCi/g but less than 70, a processor authorized by CHFS could downblend the waste to bring it below 50 for disposal in a contained landfill. No members of the Work Group expressed further comment.
- **Discussion of Down Hole Disposal:** The work group discussed the two documents that had been sent prior to the meeting for their review. Representatives from the oil and gas industry were asked to summarize the issues related to tubular goods and disposal options. The Texas approach was viewed as a good start to consider. Members were told that removing tubular goods from the bore hole increases worker exposure and increases risk. The scale, sludge and tubular goods are often left in the borehole and cemented in place at depth during the well plugging process which isolates the materials from exposure and prevents migration to groundwater. Division of Oil and Gas issues plugging instructions and staff are onsite during the plugging. Questions were raised on whether materials should be limited to where they are generated and who can consent to disposal. Bill Barr and Tom FitzGerald committed to put together a draft for the Work Group's review.
  - **CHFS Presentation on Draft Regulation:** Curt Pendergrass provided an overview of sources of TENORM that they have dealt with and exemptions that have been issued by the cabinet. Laura Begin summarized the draft regulation and reviewed the structure and elements of the regulation. Larry Taylor asked that the Work Group consider the regulation from two perspectives: how does this affect oil and gas operations and are there concerns with the other portions. CHFS intends to provide outreach to other affected parties and will address concerns as they arise during the promulgation process. Specific issues discussed included a manifest being used for over 50 pCi/g and waste management industry had suggested a 'waste profile' that meets the needs of a manifest for less than 50 pCi/g. A clarification was requested by the Work Group that 5 to 50 pCi/g was the sole responsibility of EEC. A question was raised about whether over 50 would be specifically licensed by CHFS. A question was also raised about whether the statutory definition needs to be revised first and the process of how that is done with the Compact Commission. In reference to the draft regulation, there

was considerable concern with how concerns and opposition from other parties affected by the regulation could delay the process. The Work Group has an opportunity for a quick 'win' with respect to HB563. While it is understandable that CHFS has needs to address and exempt other sources of TENORM and NORM, most members of the Work Group expressed significant concern and suggested an incremental or phased approach with addressing oil and gas operations first and then the cabinet could follow that with specific amendments for the other sources. The Work Group asked when the EEC draft regulations will be ready to share. Larry Taylor said that they hope to be able to provide a draft for the next meeting.

- **Draft Report to LRC:** Larry Taylor described the format of the draft report and asked that Work Group members provide any comment on the report to Rick in the coming weeks.
- **Tasks assigned for the next meeting of the workgroup.**
  - Tom FitzGerald will update the Working Document to reflect identified changes.
  - Bill Barr and Tom FitzGerald will develop a draft approach for down hole disposal of tubular goods.
  - EEC will provide draft regulations for the Work Group's review for the next meeting.
- **Public Comment:** The workgroup did not receive public comment at this meeting.
- **Next Meeting:**
  - The next meeting is scheduled for November 1, 2016 at 9:00 am in the Energy and Environment Cabinet's Training Room 116-C.
- **Adjournment**

## **Oil and Gas Workgroup Minutes Meeting #7**

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Minutes of the seventh meeting held on November 1, 2016: A meeting of the Oil and Gas Workgroup was held in the Energy and Environment Cabinet First Floor Training Room C in Frankfort KY.

- **Members Present:** Bill Barr, Maurice Royster, Monty Hay, Steve Coleman, Rudy Vogt, John Horne, Kim Collings, Reggie Van Stockum, Scott Smith, Rusty Cress, Larry Taylor, Matt Sawyers, Curt Pendergrass, Scott Smith, and Tom FitzGerald.
- **Support Staff and Citizens Present:** Deputy Secretary Bruce Scott, Laura Cole, David Rettell, Sherman Brown, Deanna Picklesimer, Jennifer Wolsing, Haley McCoy, James

Bruggers, Gregory Butler, Steve Hohmann, Laura Begin, Taylor Bumgardner, Lane Boldman, and Kate Shanks

- **Meeting Time:** The meeting was called to order at 9:05 am EST.
- **Opening Remarks:** Rick Bender made opening remarks and reviewed the agenda. The meeting started according to the provided agenda.
- **Discussions:** There was initial discussion on the path forward regarding the report to be given to the legislature as well as the workgroups process for implementing the proposed regulation amendments.
  - **Discussion of the revised working document:** The workgroup reviewed the version of the draft dated 10/22/2016 drafted by Tom FitzGerald.
    1. There was continued discussion on total activity and how that is determined.
    2. Concern was expressed that a time of high levels of oil and gas activity could result in a landfill being shut down due excessive amounts of oil and gas wastes.
    3. Rusty Cress mentioned that DEP determines the load for a landfill during the permitting process.
    4. Tom FitzGerald agreed to amend the working document language to include the information regarding volume and activity to prevent overloading a landfill.
  - **Discussion of Down Hole Disposal:** The workgroup discussed downhole disposal.
    1. Rudy Vogt mentioned that the reclamation plan is required before drilling and couldn't account for downhole disposal.
    2. A member of the oil and gas industry commented that the division needs the authority to determine the thickness of the cement plug.
    3. An entity wishing to re-enter a plugged well will need a permit from DOG. DOG will need to ensure this information maintained and reviewed.
    4. The workgroup had no desire to require entities to go in and remove scale from drilling tubes. Scale is one of the most hazardous components. Couplings are where most scale accumulates making them have highest concentration of TENORM.
    5. Disposal of TENORM at a regulated facility is preferable to storage onsite.
  - **Draft Report to LRC:** Larry Taylor went over the draft report with the workgroup. The workgroup approved the format and contents of the report. However, CHFS

representative asked the report include the codified version of HB 536 in the report. Also representatives for the oil and gas industry asked that “KOGA” not be used in the report because the information agreed to in the workgroup has not received the full approval of KOGA only some of the members of KOGA. They asked that “members of the oil and gas industry” be used instead.

- **Tasks assigned for the next meeting of the workgroup.**
  - Tom FitzGerald will update the Working Document to reflect identified changes.
  - A redraft of the working assumptions document is due to the workgroup by November 29th.
  - All revised documents are due to the workgroup by December 5th.
- **Public Comment:** The workgroup did not receive public comment at this meeting.
- **Next Meeting:**
  - The next meeting is scheduled for December 9, 2016 at 9:00 am in the Energy and Environment Cabinet’s Training Room 116-C.

## **Adjournment**

## SECTION 6. FINDINGS AND RECOMMENDATIONS

1. The Oil and Gas Workgroup met and collaborated to address the oil and gas related issues identified by HB563 and codified as KRS 211.893 and has developed the following findings and recommendations. **Definitions**

The definitions currently in statute are in need of revision. The workgroup defined two terms that are consistent with adjacent states and the Conference of Radiation Control Program Directors.

- a) TENORM, or Technologically-Enhanced Naturally Occurring Radioactive Material, means naturally occurring radioactive material whose radionuclide concentrations have been increased by human activities above levels encountered in the natural state. TENORM does not include the natural radioactivity of rocks or soils, and does not include “source material,” “byproduct material,” or “special nuclear material” as those terms are defined in the Atomic Energy Act of 1954, as amended (42 USC 2011 et seq.) and relevant regulations implemented by the Nuclear Regulatory Commission.<sup>2</sup>
- b) NORM, or Naturally Occurring Radioactive Material means any of the primordial radionuclides or radioactivity present in soils, rocks, and materials not concentrated as a result of human activities.

### 2. **Assumptions**

The workgroup documented several assumptions leading up to the findings and recommendations.

- a) These working definitions and assumptions apply solely to the characterization and management of materials related to oil and gas production.
- b) KRS 211.863 prohibits importation and receipt of any material containing low-level radioactive waste, which includes NORM that is generated out of state from any source, unless approved by the Central Midwest Low-Level Radioactive Waste Compact

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<sup>2</sup> The Regional Management Plan (RMP) states that “NORM contaminated wastes are sometimes referred to as technologically enhanced NORM or TENORM. This differentiates between NORM present in the natural environment and useful products from TENORM waste produced as a result of a man made process.”

The RMP in regards to Low Level Radioactive Waste states that “[t]he definition does not exclude waste comprised of naturally occurring radioactive material (NORM) or waste comprised of naturally occurring or accelerator produced radioactive material (NARM). Accordingly, because it does not fall within one of the exclusions, waste containing NORM or NARM is LLRW under the Compact and is subject to the Compact’s requirements concerning storage, treatment, and disposal of LLRW.

Commission (Compact Commission). Nothing in the TENORM regulations that will be promulgated pursuant to these working assumptions will change that current prohibition.

- c) The workgroup concurs that the current default level of 1,999 pCi/gram for disposal of in-state NORM or TENORM in contained landfills may not be protective of public and workplace safety and health under certain exposure scenarios, and that an upper-bound regulatory limit is needed that is protective during and after the useful life of the landfill. This working assumption is guidance for the group but is not intended to be incorporated as regulatory language.
- d) CHFS and EEC have conducted outreach to radiation control and waste management agencies in oil and gas-producing states regarding oversight of companies engaged in management and transportation of TENORM and NORM in order to prevent, to the extent possible, importation into Kentucky for disposal of wastes in violation of the Central Midwest Low-Level Radioactive Waste Compact. EEC has conducted that outreach to natural resources and radiation control agencies in Ohio, Indiana, Maryland, Pennsylvania, New York, Missouri, Tennessee, West Virginia, Virginia, and New York and has shared those letters with workgroup. The Cabinet for Health and Family Services sent TENORM outreach letters to all radiation control program managers in the United States to provide notification and clarification of the Kentucky laws regarding NORM, TENORM, and Low-Level Radioactive Wastes that advised those states of the import prohibition from states outside of the Central Midwest Low-Level Radioactive Waste Compact.
- e) The management of oil- and gas-related TENORM should be guided by science and should be risk-informed and dose-based. The dose-based values for radionuclides in TENORM waste should be expressed in quantitative terms for purposes of regulatory compliance. Authorized limits for radium-226 should be developed for the disposal of TENORM expressed as concentrations in pCi/g derived from a target dose.
- f) Any regulatory framework developed or modified to assure proper management of oil- and gas-production NORM or TENORM should be effective both in protecting public and workplace safety and health, and in allocating government and private sector resources in the most cost-effective manner to achieve those ends. The upper-bound regulatory limit for free release should be 25 mrem/yr for protection of public health.<sup>3</sup>

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<sup>3</sup> The 25 mrem/yr is consistent with the performance objectives for regulated low-level radioactive facilities and free release limits of 902 KAR 100:042, Section 2.

### **3. NORM and TENORM Management**

The workgroup developed a tiered process for regulation of TENORM. The management and disposal of materials with naturally-occurring radioactivity and naturally-occurring radioactivity that has been technologically enhanced is based on exposure risk and management of risk below health-based doses. The workgroup will recommend that administrative regulations for the Energy and Environment Cabinet and the Cabinet for Health and Family Services be amended to incorporate this tiered approach.

#### **a) Exempt or Specific Waste Sources:**

- i. Water produced from or utilized during oil or gas well development or production operations, including water flowed back following hydraulic fracturing operations, that is disposed of in wells that are permitted and regulated under the Underground Injection Control (UIC) program are exempt from further regulation.
- ii. Materials exhibiting a radium-226 concentration of at or below 5 pCi/g should be exempted from additional regulation due to *de minimis* health risk from exposure. Soils exhibiting a radium-226 concentration of at or below 5 pCi/g above background as measured within the first 15 cm below ground surface averaged over 100 square meters should be exempted from additional regulation for the same reason.
- iii. Drill cuttings from exploration or production wells, including drill cuttings from horizontal well drilling, that are disposed of on-site shall be buried at a depth of one and 1/2 feet below ground surface, and may be buried only in conjunction with the closure of on-site pits. A pit shall be closed with a 12 mil liner over the cuttings and 1 and 1/2 feet minimum of soil graded and revegetated in order to minimize erosion. The current permit-by-rule in 401 KAR 45:060 for drilling muds shall be revised to include drill cuttings, and to reflect the minimum depth revision. The Energy and Environment Cabinet will amend Division of Oil and Gas regulations in 805 KAR 1:170 to address construction, management, and closure of a pit. Regulations in 401 KAR Chapters 45 and 48 will be amended to describe disposal of TENORM in landfills.
- iv. Brine/sludge pit contents, scale and residue from heater-treaters, facilities used for storage of produced waters, such as pits and tank batteries, piping and tubing, wastewater storage or recycling tanks and equipment, and other wastes generated in state by oil or gas production operations employing secondary recovery or wastes associated with high-volume hydraulic fracturing, shall be characterized and analyzed by the generator for radium-226 prior to handling and shipment for disposal in a landfill meeting the design and other requirements of a contained



landfill and shall be subject to these requirements. Material can be characterized in regards to total radiation activity where cleaning of piping or other material would result in potential exposure to workers. Disposal must be characterized with regard to pCi/g. Results of the characterization, analysis, and data verification, including any sampling shall accompany the waste shipment and copies of such sampling and certification shall be maintained by the generator and by the solid waste facility accepting the waste. Characterization, analysis, data verification shall be conducted using methodology identified and approved by the CHFS Radiation Control Branch under licensure.

**b) 5 pCi/g to  $\leq$  50 pCi/g:**

- i. 401 KAR 48:090 should be modified to require all contained landfills to develop a plan for management of oil and gas-related waste including whether they will accept waste related to oil and gas production and management of that waste. If the concentration of radium-226 in the oil or gas waste is above 5 pCi/g but below 50 pCi/g, acceptance of the waste by any landfill meeting the design and other requirements of a contained landfill shall be allowed without restrictions on the handling and disposal of the wastes, provided that the material shall not be used for daily cover or alternative daily cover in order to comply with ALARA principles.

**c)  $>$  50 pCi/g**

- i. 401 KAR 48:090 should be modified in order to address the necessity to prepare and implement a plan for inspection and operating requirements for landfills relating to acceptance of NORM or TENORM containing above 50 pCi/g of radium-226. The authorized limits for radium-226 and total activity permitted for a landfill or cell, will be developed by CHFS based on potential future exposure post-closure of the landfill and will be expressed as numeric values in the regulation.<sup>4</sup> The disposal limit for radium-226, based on RESRAD 7.0 with an exposure assumption of 25 mrem, is 238 pCi/g.

For any landfill accepting TENORM waste with a concentration of radium-226 above 50 pCi/g, dosimetry would be required for a minimum of 8 quarters. If dosimetry

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<sup>4</sup> Per DOE Order 458.1, "An authorized limit is a limit on the concentration or quantity of residual radioactive material on the surfaces or within property that has been derived consistent with DOE directives including the ALARA process requirements. An authorized limit may also include conditions or measures that limit or control the disposition of property."

results averaged over each of the 12 month periods are less than 200 mrem/yr,<sup>5</sup> suspension of use of dosimeters could be requested and approved. CHFS has authority under 902 KAR 100:015, upon application, to grant such exemptions or exceptions as it determines are authorized by law or regulation and that will not result in undue hazard to public health, safety, or property.

- ii. Disposal facilities accepting TENORM waste with a concentration of radium-226 in excess of 50 pCi/g shall register with CHFS and operate in accordance with a permit issued by EEC based upon these standards established by EEC and CHFS. TENORM-containing waste over 50 pCi/g of radium-226 cannot be used as alternative daily cover, and the facility is subject to any conditions in host agreements restricting or precluding disposal of NORM and TENORM.
- iii. For any landfill accepting waste with a concentration greater than 50 pCi/g, the final cap design shall be enhanced to meet the standards of a Part C landfill under the Resource Conservation and Recovery Act. Downblending of TENORM waste either prior to or after characterization, except as provided below, is prohibited. The decision on how the TENORM-containing waste is to be managed shall be based on the concentration prior to any solidification of the waste. Solidification of wastes for the sole purpose of allowing the landfilling of such wastes and downblending as provided below, is permitted, provided that the person shall have first received a license to engage in such activities from the CHFS and meets the performance standards and recordkeeping requirements to be established by CHFS and EEC. Downblending may be utilized only to achieve the 50 pCi/g limit only where the concentration of radium-226 prior to any solidification or downblending is less than 70 pCi/g and the downblending is performed by a processor authorized to enhance, treat, or produce TENORM. The prohibition on downblending would not prevent a landfill from engaging in normal activities associated with spreading of wastes that might result in lowering of overall concentration values, provided that prior to receipt of the waste, characterization demonstrating compliance with the authorized limit is documented. This is a radiation issue that can be addressed in the license.
- iv. If the concentration is above the authorized limit developed in Subsection 3(c)(i) for radium-226, the waste load shall not be sent to or received by any landfill regulated under 401 KAR Chapters 45, 47 and 48 but shall instead be disposed of in a licensed low-level radioactive waste facility.

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<sup>5</sup> 10 CFR 20.1502 Conditions requiring individual monitoring of external and internal occupational dose.

**d) On-site downhole disposal of tubular goods, sludge, and scale containing TENORM may be allowed by the Division of Oil and Gas in conjunction with plugging and abandonment of any oil or gas production well provided that the following standards are met and an inspector from the Division of Oil and Gas is present for the duration of the disposal and plugging activity:**

- i. The operator certifies that the owner of the oil and gas rights has consented, by lease or other document, to allow such on-site disposal of TENORM waste;
- ii. The TENORM waste was generated at the lease or unit where disposal is proposed;
- iii. The TENORM waste shall be placed in the well at a depth of at least 200 feet below the base of any underground source of drinking water (i.e. with a TDS concentration of 10,000 ppm or less);
- iv. The TENORM waste shall be placed in a controlled manner in the well;
- v. A cement plug shall be placed below the TENORM waste, isolating the waste from any producing formation and preventing migration of TENORM waste below the disposal interval, with the DOG specifying the thickness of the plug, the type of cement to be used, and how the cement is to be placed in the wellbore. The well shall be cemented from above the TENORM waste to the top of the well;
- vi. The cement of the surface plug shall be color dyed with red iron oxide;
- vii. A permanent marker that shows the three-bladed radiation symbol shall be inserted into the upper surface of the top cement plug or welded to a steel plate at the top of the well casing;
- viii. The operator shall apply to dispose of TENORM downhole, on a form developed by the Division of Oil and Gas, which application shall contain the following information:
  1. A description of the type or types of TENORM waste so disposed (i.e. pipe scale, contaminated soil, sediment, equipment, piping tubing, valves, sucker rods, etc.)
  2. The approximate volume of each type of waste so disposed;
  3. Results of analysis of radium-226 for soil and other media, and report of gamma ray dose rate  $\mu\text{R/hr}$  for pipe and other tubular goods in which TENORM is entrained as scale;

4. The name, permit number, and location of the well to be plugged in which TENORM waste is proposed to be disposed;
  5. The formation or formations from which the NORM waste originated.
- ix. A copy of the application shall be provided to the CHFS Radiation Control Branch and to the owner of the surface estate at the time of filing of the application.

## **SECTION 7. FUTURE STEPS**

The work group made significant progress toward the goals of the legislation. The members of the work group and those in attendance provided meaningful and productive discussions and input that has resulted in the work group producing a working definitions and assumptions document that is intended to provide a framework for an oil and gas regulatory approach based on stakeholder involvement. This collaborative work product has aided in identifying necessary clarification and regulatory changes. This is a working document and does not represent final consensus on all issues. In the remaining meetings the group will complete the study of oil and gas development and production as required by KRS 211.893 and resolve any outstanding issues in regard to appropriate characterization and management of materials associated with oil and gas operations. The work group will publish a final report with findings and recommendations.

Based on the findings and recommendations of the work group, the executive branch agencies will coordinate with members of the General Assembly to develop and implement proposed legislative changes that will specifically clarify and streamline the definitions of NORM and TENORM in KRS 211.862. With the workgroup issuing findings and recommendations, administrative regulations will also be amended in a coordinated effort to ensure that the amendments are filed and implemented concurrently in consultation with the oil and gas workgroup. The administrative regulation amendments will establish limits for disposal of TENORM wastes at landfills. The regulations will establish a classification process based on waste characteristics and radionuclide concentration and appropriate management of wastes associated with oil and gas development and production. The regulations will address proper construction, operation and closure of pits used for oil and gas drilling and to ensure that wastes generated will be properly characterized, transported and disposed.

The executive branch agencies will provide outreach to ensure that the changes are clear and understandable and ensure that the Kentucky oil and gas industry has options available for addressing and managing materials that are generated in the drilling and development process and that the management of those materials is protective of current and future exposure to workers and the public.